Energy, power and resistance | **Resistance and resistivity**

Learning objectives		
	MUST (C)	Be able to state the factors that affect the resistance of a wire
	SHOULD (B)	Explain what is meant by resistivity, and how it can be experimentally determined
	COULD (A/A*)	Carry out calculations involving resistivity

STARTER: Think about a wire. Which of these characteristics are affected by the shape of the wire, and which are properties of the material it's made of?

resistance mass — affected by shape

density melting point number of free electrons — properties of material

EXTENSION: Think specifically about the resistance. What affects it?

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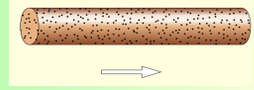
MUST (6) Be able to state the factors that affect the resistance of a wire

Resistance is a measure of opposition to the flow of charge carriers. What factors in the shape of a wire will affect resistance, and how? How do you think we can take material into account?



Resistance is proportional to length and inversely proportional to the cross-sectional area. An extra factor called the **resistivity** is included to take account of the properties of the material.

Resistivity: a measure of a specific material's opposition to charge flow. A low resistivity means that charge can flow easily in this material.

$$R = \frac{\rho l}{A}$$

The units of resistivity are..... Ωm

Can you think of possible pitfalls with this equation?

area must be in m^2!

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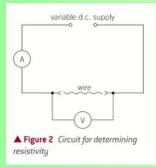
SHOULD (7) Explain what we mean by resistivity, and how it can be experimentally determined

How could you find the resistivity of a material?



▲ Figure 2 Circuit for determining resistivity

If you took a wire and measured the current and p.d. across different lengths of the wire, you could calculate the resistance for each length.

What would the graph of resistance against length look like?

Extension: how could you find the resistivity?

Hint: write down the resistance equation, and think how it might relate to the equation for the shape of the line you've chosen.

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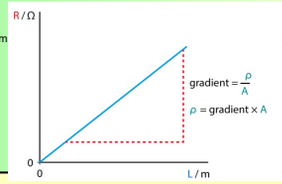

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COULD (8/9) Carry out calculations involving resistivity

Answer the questions that you have been given.

Then choose level 2 or 3 application questions

Answers

1 7.9×10^{-8} Ω m to two significant figures (7.85×10^{-8} Ω m) (2 marks)
2 0.32 m (2 marks)
3 a 43 Ω to two significant figures (43.2 Ω) (2 marks)
b If L and D is halved, the resistance will double:
R = 86 Ω to two significant figures (86.4 Ω) (1 mark)
4 0.63 mm (3 marks)
5 $I = \frac{P}{V} = \frac{100\,000}{500} = 200$ A (1 mark)
Power lost = 6000 = $200^2 R$ (1 mark)
R = 0.15 Ω (1 mark)
So d = 1.0 cm (1 mark)

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PLENARY:

Two wires, X and Y, are made of the same material.

X is twice as long and also has double the cross-sectional area.

What is the ratio of Rx/Ry? (Resistance of wire X/resistance of wire Y)

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